

Science Council of British Columbia

Eighth Annual Report
1985-86

Presented to the
House of Commons

86-06761/



Table of Contents

Page	3	Letter of Transmittal
Page	4	Members and Staff
Page	7	From the Chairman
Page	8	Year in Review
Page	12	A.G.A.R. Research Grants
Page	20	G.R.E.A.T. Scholarships
Page	24	I.P.D.F. Fellowships
Page	25	Financial Statements





June 30, 1986

The Honourable Patrick L. McGeer
Minister of International Trade, Science and Investment
Province of British Columbia
Parliament Buildings
Victoria, B.C.
V8V 1X4

Dear Dr. McGeer:

I have the honour to present to you the Eighth Annual Report of the Science Council of British Columbia, and of the Secretariat on Science, Research and Development for the year ended March 31, 1986.

Respectfully submitted,

Denis Connor
Chairman
Science Council of British Columbia

Chairman



Dr. D.J. Connor

Executive Director



Dr. J.T. Sample



Dr. W.M. Armstrong



Mr. G.S. Balcom



Dr. D.H. Copp



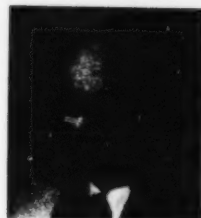
Dr. J.M. Dewey



Dr. J.H. Dirks



Mr. K.A. French



Dr. D.A. George



Mr. B. Hodges



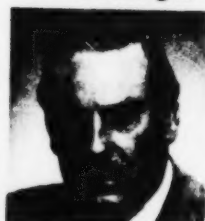
Dr. T.E. Howard



Dr. P.A. Larkin



Dr. G.A. May



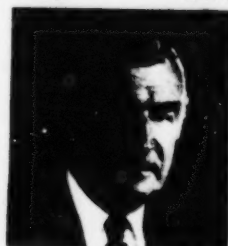
Mr. D.F. Miller



Dr. G.W. Poling



Dr. I.H. Warren



Mr. A.R. Williams

Members of The Science Council of British Columbia

MEMBER	DATE OF APPOINTMENT	CURRENT TERM EXPIRES
Dr. D.J. Connor Vice President, Corporate Development MacDonald Dettwiler & Associates Richmond	February 20, 1985 (Chairman from January 15, 1986)	February 20, 1987
Dr. W.M. Armstrong Retired Vancouver	January 29, 1982	Honorary Member
Mr. G.S. Balcom President Harmattan International Consulting Limited Vancouver	March 24, 1983	July 18, 1987
Dr. D.H. Copp Department of Physiology University of British Columbia	January 30, 1981	March 14, 1987
Dr. J.M. Dewey Vice President Academic for Research University of Victoria	February 13, 1985 (Chairman from March 14, 1985 to October, 1985)	February, 13, 1987
Dr. J.H. Dirks Head, Department of Medicine University of British Columbia	December 5, 1985	December 5, 1987
Mr. K.A. French President Forintek Canada Corporation Vancouver	February 23, 1984	February 23, 1986
Dr. D.A. George Dean of Applied Sciences Simon Fraser University	July 28, 1983	July 18, 1987
Mr. B. Hodges President Windsor Machine Company Ltd. Burnaby	June 13, 1984	June 13, 1986
Dr. T.E. Howard Executive Director B.C. Research Vancouver	July 26, 1984	July 26, 1986

Members *cont.....*

MEMBER	DATE OF APPOINTMENT	CURRENT TERM EXPIRES
Dr. P.A. Larkin Vice President Research University of British Columbia	March 14, 1985	March 14, 1987
Dr. G.A. May President George A. May & Associates Ltd. Sooke	July 28, 1983	July 18, 1987
Mr. D.F. Miller Corporate Director Vancouver	December 14, 1983	December 14, 1985
Dr. T.W. Pearson Department of Biochemistry and Microbiology University of Victoria	December 3, 1981	Resigned, July, 1985
Dr. G. W. Poling Head, Department of Mining and Mineral Process Engineering University of British Columbia	February 23, 1984	February 23, 1986
Dr. I.H. Warren Technical Consultant Research & Development Department Chemetics International Vancouver	June 13, 1984	June 13, 1986
Mr. A.R. Williams Corporate Director Vancouver	February 23, 1984	February 23, 1986

Research Secretariat of B.C. Staff (April 1985-March 1986)

Dr. J.T. Sample	Executive Director
Dr. M.A. Cairns	Associate Director
Miss T.L. Bowyer	Receptionist/Secretary
Mrs. M.G. Eickhoff	Secretary (B.C. HCRF)
Mrs. P.A. McKeever	Secretary
Mr. D.G. McPherson	Accountant (part-time consultant)
Mr. D.A. Rodger	Information Officer (part-time consultant)
Mr. R.W. Warner	Awards Officer
Dr. D.B. Whitney	Awards Officer (B.C. HCRF)

From the Chairman



The Science Council of British Columbia was founded in 1978 during a period of growth and prosperity throughout B.C. The traditional resource base of the provincial economy was providing a strong impetus for growth. By 1982, a scant three years later, the worldwide economic downturn had severely constrained our economy. Major resource sector companies were faced with disaster and had to take draconian measures in order to survive. By 1985, these measures had borne fruit, at least in the lumber sector, which was producing at or near record levels, and was doing so with 30% fewer people. Although these companies have survived, they are just breaking even because increased foreign competition has kept prices low. A key element in their survival strategy has been the introduction of the best available technology throughout their industry.

During this whole period, the Science Council has been working to foster the use throughout the B.C. economy of the best available science and technology. In 1985, we obtained the first quantitative measure of the success of these Science Council activities, when the "Walden report" documented that the Assistance Grants for Applied Research (AGAR) program would achieve a twenty-to-one payback on funds expended to that time. The big success stories documented in the report are typical of the technology-based products and processes that are revitalizing existing B.C. companies or that are the basis for fast-growing new companies.

The success of the AGAR program and the other equally important and successful programs for graduate education, industrial postdoctoral fellowship and science awareness demonstrate that the Science Council is functioning effectively as a unique element in the B.C. economy. The Council and its review subcommittees consist of about 60 people in total who are drawn from all segments of industry, the university science and engineering departments, the local research institutes and various government departments. These volunteers, along with the small, dedicated group at the Research Secretariat, are proud of the results achieved by the individuals and companies assisted by the Science Council. They represent a unique, cross-sectoral and cross-institutional capability for promoting the rapid and cost-effective transition of all sectors of the B.C. economy into the knowledge-intensive, competitive stance that will be needed in the worldwide economy of the late 1980's and early 1990's.

Denis Connor

The Year in Review

The Walden Report

The best news of the year for the Science Council came in the form of a report prepared by an independent research consultant, Dr. Craig Walden of Vancouver. From 1980 to 1984 over 200 different projects received Assistance Grants for Applied Research (A.G.A.R.) from the Science Council, and in June, 1985, Dr. Walden, former Associate Director of B.C. Research and Director of Research at Forintek Canada Corporation, was commissioned to determine what effect those grants had had.

Dr. Walden questioned people involved with the 207 projects that had received A.G.A.R. funds between 1980 and 1984. Top priority was given to his finding the value of sales of new or improved products or reduced manufacturing costs resulting from the grants. He conducted personal interviews with project leaders and sought outside opinions and data from academic and business consultants to verify claims.

He found that, of the projects surveyed, 123 have reached a firm commercial conclusion. Either they have created an economic benefit or they have been discontinued for technical or commercial reasons. The remaining 79 projects are still in the research and development phase.

The results of Dr. Walden's study were made public by Dr. Pat McGeer, Minister of International Trade, Science and Investment at a press conference in Vancouver in the spring of 1986. A detailed summary was prepared for circulation at that time. It showed that twenty seven of the completed projects are already injecting substantial sums of money into the provincial economy. They include:

1. the Transvac vacuum fish pump made by Innovac Technology Incorporated of Richmond,
2. the FIRE 9000 film recorder developed by MacDonald Dettwiler and Associates of Richmond for electronic circuit plotting,
3. the development by Phero Tech Incorporated of Vancouver of synthetic insect pheromones and traps to control the beetles that attack trees and timber,
4. the introduction, by the commercial nursery trade, of new plants from the University of British Columbia Botanical Garden, and
5. ways of shortening the growth period for cultured oysters at Redonda Sea Farms in Desolation Sound.

By the end of 1985, the total return from these five and 22 other successful projects was \$8.5 million. The cumulative benefits to the end of 1987 should be in the area of \$45.3 million, more than four times the Science Council's investment in them!

The most impressive figures come from the long-range projections. Using a reasonable estimate of the life-cycle of new technologies, Dr. Walden found that over the next fifteen years, the Science Council's investment in those 27 projects should return nearly \$233 million to the provincial economy. That figure comes from the percentage of each project's benefits that can be reasonably attributed to the

The Year in Review *Cont.....*

Science Council's contribution to them. Based on the amount the Science Council invested in all 123 complete projects—\$12 million—the return is approximately twenty to one. Meanwhile, other projects are being brought to market all the time so the return on the Science Council's investment may go much higher!

This report provides proof that investment in applied scientific and engineering research in British Columbia is a sound and economically-rewarding use of public funds.

Assistance Grants for Applied Research

There were two competitions for the Science Council's Assistance Grants for Applied Research in the 1985-86 fiscal year. In September, \$1,448,003 was awarded to 25 projects. This was the twelfth competition (RC-12) since the program began in 1980. In March, 44 projects shared \$1,762,620 in the thirteenth competition (RC-13).

A new subcommittee was established to review the increasing number of applications in the field of Computers and Computing. The other nine subcommittees are Agriculture and Food; Aquatic Sciences; Biotechnology; Electronics and Communications; Energy; Forests and Forest Products; Manufacturing and Machinery; Mining, Minerals and Metals and Transportation.

G.R.E.A.T. (Graduate Research, Engineering And Technology) Scholarships

The Science Council wants to encourage more young people to consider careers in science and engineering. The G.R.E.A.T. scholarships are one of the ways this can be done. To qualify for a G.R.E.A.T. scholarship, an applicant must be a graduate student in science or engineering at one of the province's universities. A thesis based on original research is one of the requirements for a master's degree or Ph.D and, under this program, the research must be carried out in cooperation with an off-campus B.C. company or organization.

Using the facilities of the cooperating company or organization a student gains valuable practical experience. The company or organization usually benefits, too, because the students help solve certain technical problems. The G.R.E.A.T. program also encourages improved contacts between the universities and the community.

Fifty two students received the \$12,000 scholarships in the spring of 1986 to allow them to continue their studies for the next year.

Industrial Postdoctoral Fellowships

The Science Council will award an Industrial Postdoctoral Fellowship (I.P.D.F.) worth \$25,000 to help B.C. companies pay the salary costs of recent Ph.D. graduates. The main requirement is that these men and women be employed in positions appropriate to their field of expertise.

In 1985-86, ten Industrial Postdoctoral Fellowships were awarded to companies in Burnaby, Langley, Sidney and Vancouver. The fellowships are worth \$25,000 each and may be renewed once.

The Year in Review *Cont.....*

1985 British Columbia Science and Engineering Awards

Two scientists, Dr. John Borden and Dr. Robert Noble, and an engineer, Dr. Keith Brimacombe, won the 1985 British Columbia Science and Engineering Awards. Premier Bill Bennett presented each winner with a gold medal and plaque at a dinner held in their honour at the Four Seasons Hotel in Vancouver in October.

Dr. Borden, a member of the Department of Biological Sciences at Simon Fraser University, was cited for his research leading to ways of controlling the insects that destroy millions of dollars' worth of prime timber in the province every year. His award was in the category of Applied Natural Sciences.

Dr. Brimacombe, the first engineer to receive an individual award, is a specialist in the analysis, design and modelling of metallurgical processes. He is Stelco Professor in the Department of Metallurgical Engineering at the University of British Columbia. His award was in Applied Science.

Dr. Noble is a staff researcher at the Cancer Control Agency of British Columbia. Earlier in his career, he played a key role in the discovery of Vinblastine, one of the first and still most effective chemicals used in the treatment of leukemia and other cancers. His award was in the Health Sciences category.

Special Awards and Grants

The Science Council sets aside some of its funds to help stimulate interest in, and appreciation of science in the community. For example, the Council provided a special grant to support the salary for one year of the newly-appointed Director of the Arts, Sciences and Technology Centre in Vancouver.

This was the year of the long-awaited return of Halley's Comet. The Science Council made a grant to the H.R. MacMillan Planetarium to enable it to publish material and produce visual aids concerning the comet, for public distribution.

A grant was awarded to the Youth Science Foundation to support the staging of regional high school science fairs throughout British Columbia and to enable the winners to attend the national competition in Calgary.

The Science Council awards the prize of a book to the top science student in the graduating class at participating secondary schools throughout the province.

Other Activities

From time to time, the Science Council is asked to review and comment upon matters referred to it by the Minister of International Trade, Science and Investment. For instance it is now evaluating the possibility of establishing a Forest Biotechnology Centre in the province.

The Year in Review *Cont.....*

Members of the Science Council

The fifteen members of the Science Council are appointed, normally for two-year terms, by the Minister of International Trade, Science and Investment. They include distinguished scientists and engineers from the universities and research institutes as well as people prominent in the world of business and industry in British Columbia.

Dr. Terry Pearson of the University of Victoria retired from the Council during the year. He was replaced by Dr. John Dirks, Head of the University of British Columbia Department of Medicine.

A complete list of current members is published on page 5 in this report.

The Secretariat on Science, Research and Development

Science Council members volunteer their time. So do members of the subcommittees that review the A.G.A.R. applications, the Scholarship and Fellowship Committee that considers both G.R.E.A.T. and Industrial Postdoctoral Fellowship applications, and the Subcommittee that reviews the nominations for B.C. Science and Engineering Awards each year. Ongoing administration of these programs and other Council activities is provided by the staff of the Secretariat on Science, Research and Development (the "Research Secretariat") under the direction of Dr. J.T. Sample.

The Secretariat, with a full-time staff of seven, provides services to both the Science Council of British Columbia and the British Columbia Health Care Research Foundation. It advises and distributes information to potential applicants, processes applications and constantly monitors the progress (and, sometimes the lack of it) of each researcher.

The Secretariat organizes the Council's regular meetings as well as those of the various standing committees. It maintains close contact and exchanges information with other organizations across the country which have a specific interest in developing Canada's scientific and technological resources.

**Science Council of B.C.
Schedule of Assistance Grants for
Applied Research (A.G.A.R.) Commitments
for the year ended March 31, 1986**

1. Research Grant Competition #12 (RC-12)

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	TOTAL \$ COMMITTED 1985-86
A. AGRICULTURE & FOOD		
Dr. Bruce D. Owen (UBC, Animal Science)	Cellulosic pulp mill wastes in beef cattle finishing rations.	30,360
Mr. Bruce Macdonald (UBC, Botanical Garden)	P.I.S.B.G. (Plant Introduction Scheme of the Botanical Garden)	75,000
Dr. John M. Webster (SFU, Biological Sciences)	Commercial development of entomogenous nematodes to control certain insect pests of agriculture and forestry nursery crops in B.C.	50,771
B. AQUATIC SCIENCES		
Dr. N. Ross Bulley (UBC, Bio-Resource Eng.)	Upgrading of sewage lagoon effluent using advanced biological treatment and byproduct recovery.	37,600
Dr. Hilda L. Ching (Hydra Enterprises Ltd., Vancouver)	Improvement of potential salmonid fish productivity by the use of disease resistant stocks.	19,100
Dr. R. Monty Clements (UVIC, Physics)	Development of a new underwater acoustic source.	42,700
C. ELECTRONICS AND COMMUNICATIONS		
Mr. John E. Keightley (MacDonald Dettwiler & Associates Ltd., Richmond)	Digital film recording for the printing industry.	113,470
Dr. Albert M. Leung (SFU, Engineering Science)	Development of the "Quick-Chip" a one-day turnaround, microchip fabrication source.	159,630

1. Research Grant Competition #12 (RC-12) *Cont.....*

GRANT RECIPIENT & ORGANIZATION

PROJECT DESCRIPTION

**TOTAL \$
COMMITTED
1985-86**

C. ELECTRONICS AND COMMUNICATIONS *Cont.....*

Dr. Branko Palcic (B.C. Cancer Foundation, Vancouver)	Development of a dynamic microscope image processing scanner.	146,800
Drs. Joel G. Rogers and Brian D. Pate (TRIUMF, Vancouver)	Development of a prototype whole body PET scanner.	120,000
Dr. Lawrence Young (UBC, Electrical Engineering)	Integrated optical modulator.	44,760

D. ENERGY

No projects funded.

E. FOREST AND FOREST PRODUCTS

Dr. John H. Borden (SFU, Biological Sciences)	Integrated management of bark beetles.	37,800
Mr. Ernest A. Hamm (Forintek Canada Corp., Vancouver)	Wood density assessment of standing trees.	20,625
Dr. Cam Oehlschlager (SFU, Chemistry)	Synthesis of pheromones of economical- ly important insects by enzymatic methods.	55,200 (award declined)
Mr. Alex V. Parasin (C.O.F.I., N. Vancouver)	Strength evaluation of plywood from fast grown trees.	51,200
Dr. Paul R. Steiner (Forintek Canada Corp., Vancouver)	Foamed synthetic polymer materials for patching and coating wood panels.	29,978
Dr. Ian E.P. Taylor (UBC, Botany)	Micropropagation of embryonic and mature lodgepole pine.	57,580

1. Research Grant Competition #12 (RC-12) *Cont.....*

E. FOREST AND FOREST PRODUCTS *Cont.....*

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	TOTAL \$ COMMITTED 1985-86
Dr. Gordon F. Weetman (UBC, Forest Sciences)	Arrested plantation development on coastal cedar/hemlock sites.	33,654

F. MANUFACTURING AND MACHINERY

Mr. R. Douglas MacDonald (Robotic Systems Int'l. Ltd., Sidney)	Development of a force feedback master/slave manipulator system.	100,000
Dr. Alan D. Russell (UBC, Civil Engineering)	Productivity improvement for the con- struction industry.	49,470
Mr. Lawrence N. Scotten & Dr. David K. Walker (Vivitro Systems Inc., Victoria)	Development of a model heart and load for replacement heart valve testing.	34,480
Dr. Peter R.B. Ward (Peter Ward & Associates Ltd., Vancouver)	Design and testing of drive systems for solar powered pumps.	52,060

G. MINING, MINERALS & METALS

Dr. Janusz S. Laskowski (UBC, Mining & Mineral Process Engineering)	Emulsifying reagents in the flotation of difficult-to-treat coals.	27,435
Dr. Hamish D.S. Miller (UBC, Mining & Mineral Process Engineering)	Tunnel simulation computer model.	18,210
Dr. George W. Poling (UBC, Mining & Mineral Process Engineering)	To investigate the manufacture and evaluation of a variety of grades of perlite filter aids from expanded perlite ore mined and produced in B.C.	40,120

H. TRANSPORTATION

No projects funded.

(RC-12) TOTAL \$ COMMITTED 1985-86
(25 PROJECTS)

\$1,448,003

2. Research Grant Competition #13 (RC-13)

**TOTAL \$
COMMITTED
1985-86**

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	
A. AGRICULTURE & FOOD		
Dr. Robert Blair (UBC, Animal Science)	Improved vitamin allowances for weanling swine.	17,000
Dr. Kimberly Cheng (UBC, Animal Science)	Improvement of breeding stock for efficient squab production in B.C.	23,846
Dr. James A. Shelford (UBC, Animal Science)	Use of silage additives to improve the quality of high moisture silage.	31,000
Dr. Jeong Sim (UBC, Animal Science)	Plasma protein fractionation from animal blood waste by large scale ion-exchange chromatography.	40,000
Dr. Marvin A. Tung (UBC, Food Science)	Feasibility for commercial production and preservation of fruit-based pieces using polysaccharide gel technology.	30,258
B. AQUATIC SCIENCES		
Dr. N. Ross Bulley (UBC, Bio-Resource Engineering)	Upgrading of sewage lagoon effluent using advanced biological treatment and byproduct recovery.	20,000
Mr. Norm Gibbons (Redonda Sea Farms Ltd., Squirrel Cove)	Development of scallop culture methods in B.C.	23,000
Dr. Brian Harvey & Mr. Chris Denny (Baltic Scientific Ltd., Victoria)	Further development and testing of a tranquilizing dart for aquatic animals.	30,000
Mr. Tom Higgs (Bion Research Ltd., Vancouver)	Fermentation of whole fatty fish to produce high quality protein product.	25,000
Mr. Gordon G. Jones (Innovative Aquaculture Products Ltd., Skerry Bay)	Cryopreservation of oyster gametes and embryos.	20,000

2. Research Grant Competition #13 (RC-13) *Cont.....*

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	TOTAL \$ COMMITTED 1985-86
B. AQUATIC SCIENCES <i>Cont.....</i>		
Prof. Beryl March (Animal Science, UBC)	Factors in the utilization of dietary astaxanthin and vitamin A by salmonid fish.	25,000
Dr. Ray Peterson & Dr. Robert McKay (UBC, Animal Science)	Brood stock development of coho salmon for commercial use in B.C. aquaculture.	40,744
C. COMPUTERS AND COMPUTING		
Mr. Stephen D. Cohen (Columbia Computing Services Ltd., Vancouver)	Distributed school management database software.	40,000
Dr. Richard F. Hobson (SFU, Computing Science)	Very Large Scale Integration (VLSI) computer design.	77,140
Dr. Shuryo Nakai (UBC, Food Science)	Programming of a new optimization methodology for microcomputers	7,000
Mr. John Roberts (Softex Services Ltd., Vancouver)	Development of advanced computer software for solving large engineering structural analysis problems with math coprocessor support.	13,372
D. ELECTRONICS AND COMMUNICATIONS		
Mr. Jack Daswani (Kockums Cancar Inc., Surrey)	Development of a non-contact profile monitoring system employing fibre optic matrices.	78,845
Mr. Peter McConnell (Mobile Data International Inc., Richmond)	Development of a prototype portable position fixing system for forest engineering.	94,275
Mr. Ron McFarlane (Seastar Instruments Ltd., Sidney)	Development of a fibre optic accelerometer.	62,992

2. Research Grant Competition #13 (RC-13) Cont.....

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	TOTAL \$ COMMITTED 1985-86
E. ENERGY		
Dr. Jeff Dahn (Moli Energy Ltd., Burnaby)	Rechargeable lithium/chalcopryrite and lithium/pyrite batteries.	24,000
Dr. Phillip Hill (UBC, Innovative Vehicle Design Team)	CNG/diesel dual fuel development for small industrial engines.	22,620
Dr. Bowie G. Keefer (Highquest Technology Exploration Corp., Vancouver)	Novel chemical reactor for synthesis of ammonia and liquid fuels.	91,856
Dr. Don Sheraton and Mr. Gordon Esplin (B.C. Research, Vancouver)	Combustion enhancement by induced Rayleigh instability. Phase I: Proof of concept.	12,000
Mr. Alex Sinclair (F.E.R.I.C., Vancouver)	Propane substitution for 400 HP logging truck engines.	10,000
Dr. Paul A. Watkinson (UBC, Chemical Engineering)	Drying of hog fuel.	16,960
F. FOREST AND FOREST PRODUCTS		
Mr. Jan E. Aune (MacMillan Bloedel Research, Vancouver)	Rock, rot and knot detection in logs-sawmill application.	43,960
Dr. Fred L. Bunnell (UBC, Forestry)	Managing forest stands to supply wildlife needs.	74,984
Mr. L. James Carver (Chemetics International Co., Vancouver)	A carbonate analyser for improving energy efficiency and production in kraft pulp mills.	63,774
Mr. Bud Eysers (Talkie Tooter (Canada) Ltd., Vancouver)	Faller's emergency alarm.	26,510
Dr. James P. Kimmins (UBC, Forestry)	Development of a microcomputer simulation model for the prediction of lodgepole pine spacing responses in relation to site.	16,350

2. Research Grant Competition #13 (RC-13) *Cont.....*

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	TOTAL \$ COMMITTED 1985-86
F. FOREST AND FOREST PRODUCTS <i>Cont.....</i>		
Mr. Howard A. Leach (Carrol-Hatch (Int'l.) Ltd., N. Vancouver)	Development of an interactive sawing simulator for training headrig sawyers.	55,000
Dr. Staffan Lindgren (Phero Tech Inc., Vancouver)	New methods for manipulating popula- tions of bark beetles with semiochemicals.	38,145
Dr. John N. Owens (UVIC, Biology)	Increased cone and seed production in western hemlock seed orchards.	27,992
Mr. Michael Pottie (F.E.R.I.C., Vancouver)	Trailer steering axle for cable reach logging trailers.	25,485
Mr. Doug E. Rickson (Canadian Forest Products Ltd., Vancouver)	Propagation of douglas-fir, white spruce, and yellow cedar plantlets using tissue culturing techniques.	50,000
Dr. Bill Vidaver (SFU, Biological Sciences)	Physiological quality and performance evaluation of tree nursery planting stock.	35,000
G. MANUFACTURING & MACHINERY		
Dr. Bruce Levelton (Chatterton Petrochemical Corp., Delta)	Treatment of byproducts from benzoic acid and phenol production.	53,970
Drs. Jim McEwen & Bill Godolphin (Andronic Devices Ltd., Vancouver)	A robotic processor for hazardous blood specimens.	106,002
Mr. Gary Ramsay (Ramsay Machine Works Ltd., Victoria) & Dr. Sam Visaisouk (Retech Ltd., Victoria)	Development of an improved anti-marine fouling water treatment system for marine and land-based applications.	65,500
Dr. Diane Van Alstyne (Quadra Logic Technologies Inc., Vancouver)	Characterization of monoclonal anti- bodies to rubella virus for the production of immunodiagnostic kits.	15,000

2. Research Grant Competition #13 (RC-13) Cont.....

GRANT RECIPIENT & ORGANIZATION	PROJECT DESCRIPTION	TOTAL \$ COMMITTED 1985-86
H. MINING, MINERALS & METALS		
Mr. Derek Albon (Clayburn Industries Ltd., Abbotsford)	Carbon-bake refractories-to develop a refractory formulation suitable for lining the furnaces used to kiln-bake carbon anodes for aluminum smelter service.	73,424
Dr. Marc A.M. Bell (UVIC, Biology)	Reclaiming coal-mined lands in the Rocky Mountains with native nitrogen-fixing plants.	23,000
Prof. Carroll O. Brawner (UBC, Mining and Mineral Process Engineering)	An evaluation of grouted tensioned rock bolts and tensioned cables to strengthen rock pillars in underground mining to increase extraction, productivity, mine life, profit and jobs.	20,000
I. TRANSPORTATION		
Dr. John S. Nadeau (UBC, Metallurgical Eng.)	Acoustic emission testing of compressed natural gas (CNG) cylinders.	71,616
(RC-13) TOTAL \$ COMMITTED (1985-86) (44 PROJECTS)		1,762,620

G.R.E.A.T. Scholarships Awarded 1985-86

I. NEW AWARDS

NAME OF STUDENT	UNIVERSITY & DEPARTMENT(S)	NAME(S) OF ACADEMIC SUPERVISOR(S)	NAME(S) OF COOPERATING ORGANIZATION(S)
H.J. Ashton	UBC, Animal Science	Prof. B.E. March	Seaspring Salmon Farm, Chemainus
S.M. Banerjee	UBC, Botany	Dr. J. Maze	CIP Inc., Saanichton
J. Been	UBC, Chemical Eng.	Dr. C. Oloman	B.C. Research, Vancouver
C. Chanway	UBC, Plant Science	Dr. F.B. Holl	Richardson Seed Co., Burnaby
J.G. Chwelos	UVIC, Computer Science	Dr. W. Wadge	Island Medical Labs, Victoria
W.V. Cicha	UBC, Chemistry	Dr. F. Aubke	Molt Energy Ltd., Burnaby
S.C. Courtenay	UBC, Animal Resource Ecology	Dr. P.A. Larkin	Dept. of Fisheries & Oceans, Nanaimo
M.D. Dawkins	UVIC, Biology	Dr. J.N. Owens	Northwood Pulp & Timber, Prince George
M. Decamillis	UBC, Zoology	Dr. H.W. Brock	Quadra Logic Technologies Inc., Vancouver
E. Dyson	UBC, Animal Science	Dr. R.M. Beames	East Chilliwack Coop., Chilliwack
R.J. Favrin	SFU, Biological Sciences	Dr. J. Rahe	Ministry of Agriculture & Food, Abbotsford
D. Fayegh	UBC, Civil Engineering	Dr. S.O. Russell	Kerr, Wood, Leidal Associates, N. Vancouver
R. Fong	SFU, Chemistry SFU, Physics	Dr. I.D. Gay Dr. S.R. Morrison	Molt Energy Ltd., Burnaby
K.L. Gould	UBC, Soil Science	Dr. W.H. Schreier	Newmont Mines Ltd., Princeton
P.E. Kinahan	UBC, Physics	Dr. R.R. Johnson	TRIUMF, Vancouver

G.R.E.A.T. Scholarships Awarded 1985-86

1. NEW AWARDS *cont.....*

NAME OF STUDENT	UNIVERSITY & DEPARTMENT(S)	NAME(S) OF ACADEMIC SUPERVISOR(S)	NAME(S) OF COOPERATING ORGANIZATION(S)
M.L. Kurz	SFU, Biological Sciences	Dr. W. Vidaver	Agrogen Biotechnologies, Vancouver
N. Laing	UBC, Civil Engineering	Dr. R.G. Campanella	Conetic Investigations, Burnaby
M. Lord	UBC, Electrical Eng.	Dr. L. Young	Microtel Pacific Research, Burnaby
L.E. MacLauchlan	SFU, Biological Sciences	Dr. J.H. Borden	Environment Canada, Victoria
J.M. Nelson	SFU, Biological Sciences	Dr. B.D. Roltberg	1) Ministry of Agriculture & Food, Cloverdale 2) Agriculture Canada, Saanichton
C.V. Pearce	UBC, Resource Management Science	Dr. P.H. Pearce	Ministry of Forests, Kamloops
M. Perchanok	UBC, Mechanical Eng.	Dr. I.S. Gartshore	H.A. Simons (Int'l.) Ltd., Vancouver
D.L. Siu-Kau	UBC, Civil Eng.	Dr. S.F. Stiemer	Canron, Western Bridge Division, Vancouver
P.J. Sullivan	SFU, Kinesiology	Dr. I.B. Mekjavic	Fritz-Wright Company Ltd., Surrey
J. Taylor	UBC, Mechanical Eng.	Dr. S.G. Hutton	Forintek Canada Corp., Vancouver
R.L. Zwick	UBC, Mechanical Eng.	Dr. E.G. Hauptmann	Forintek Canada Corp., Vancouver

2. RENEWAL AWARDS (Year 2)

K.P. Andrew	UBC, Geological Sciences	Dr. C.I. Godwin	Lornex Mining Corp, Vancouver
D. Bright	UVIC, Biology	Dr. D.V. Ellis	Utah Mines Ltd., Port Hardy

G.R.E.A.T. Scholarships Awarded 1985-86

2. RENEWAL AWARDS (Year 2) *Cont.....*

NAME OF STUDENT	UNIVERSITY & DEPARTMENT(S)	NAME(S) OF ACADEMIC SUPERVISOR(S)	NAME(S) OF COOPERATING ORGANIZATION(S)
D.A. Brown	UBC, Geological Science	Dr. R.L. Armstrong	Westmin Resources Ltd., Vancouver
S.L. Cockroft	UBC, Metallurgical Eng.	Dr. G. Richards & Dr. J.K. Brimacombe	Cominco Ltd., Trail
C.M. Dilucca	UBC, Forestry	Dr. J.W. Wilson	1) Forintek Canada Corp., Vancouver 2) Ministry of Forests, Victoria
T.D. Durance	UBC, Food Science	Dr. S. Nakai	Brookside Farms Ltd., Abbotsford
D. Egles	UBC, Oceanography	Dr. P.H. LeBlond	Seaboy Marine Services, Sidney
E.P. Groot	UBC, Zoology	Dr. T.G. Northcote	Dept. of Fisheries & Oceans, Nanaimo
W. Hays	UVIC, Geography	Dr. G.M. Barber	Westmin Resources Ltd., Vancouver
K. Koenig	UBC, Animal Science	Dr. J.A. Shelford	Agriculture Canada, Agassiz
K. Lertzman	UBC, Forest Sciences	Dr. J.P. Kimmins	MacMillan Bloedel Ltd., Nanaimo
K. Mah	SFU, Biological Sciences	Dr. F. Law	Canadian Forest Products, Vancouver
J.S. Mattison	UBC, Civil Eng.	Dr. S.O. Russell	Sigma Engineering, Vancouver
E. Murray	UBC, Forest Resource Management	Dr. J.P. Dooling	C.I.P. Inc., Vancouver
R.D. Powell	UBC, Animal Resource Ecology & Plant Science	Dr. J. Meyers	Ministry of Forests, Victoria
D. Soulodre	SFU, Biological Sciences	Dr. W. Vidaver	Les Clay & Son Ltd., Langley
I.P. Street	UBC, Chemistry	Dr. S.G. Withers	Fortinek Canada Corp., Vancouver

G.R.E.A.T. Scholarships Awarded 1985-86

2. RENEWAL AWARDS (Year 2) *Cont.....*

NAME OF STUDENT	UNIVERSITY & DEPARTMENT(S)	NAME(S) OF ACADEMIC SUPERVISOR(S)	NAME(S) OF COOPERATING ORGANIZATION(S)
A.C. Thomas	UBC, Oceanography	Dr. W.J. Emery	G.A. Borstad Ltd., Sidney
D.R. Thomson	SFU, Biological Sciences	Dr. R.D. Roitberg	1) B.C. Coast Vegetable Co-op, Richmond 2) Agriculture Canada, Vancouver

3. RENEWAL AWARDS (Year 3)

M.P. Curran	UBC, Soil Science	Dr. T.M. Ballard	MacMillan Bloedel Ltd, Nanaimo
D.J. Furnell	UBC, Zoology	Dr. D.J. Randall	Dept. of Fisheries & Oceans, Nanaimo
S.H. Hill	UBC, Oceanography	Dr. S. Pond	Dept. of Fisheries & Oceans, Nanaimo
J. Howie	UBC, Civil Eng.	Dr. R.G. Campanella	Western Geosystems Inc., Surrey
R.D. Kathman	UVIC, Biology	Dr R. Ring	E.V.S. Consultants, N. Vancouver
F.G. Peabody	UBC, Electrical Eng.	Dr. W.G. Dunford	Cetec Engineering Co., Burnaby
J. Reimer	UBC, Electrical Eng.	Dr. P. D. Lawrence	Robotic Systems Int'l., Sidney

Industrial Post Doctoral Fellowships Awarded 1985-1986

1. NEW AWARDS

AWARD RECIPIENT	DISCIPLINE & YEAR OF GRADUATION	EMPLOYING COMPANY
Dr. Josef Y. Cherniawsky	Physical Oceanography 1985	G.A. Borstad Ltd., Sidney
Dr. Barry Rabinowitz	Civil Engineering 1985	Novatec Consultants Inc., Vancouver
Dr. Shawn Severn	Microbiology/Toxicology 1985	Dobrocky Seatech Ltd., Sidney
Dr. Keith Thomson	Physical Oceanography 1986	Dobrocky Seatech Ltd., Sidney
Dr. Andre Van Schyndel	Physics 1984	Ambrex International Inc, Burnaby
Dr. Rahmatollah Vefghi	Inorganic Chemistry 1982	Industrial Science Laboratories, Burnaby

2. RENEWAL AWARDS

Dr. Thomas Guthrie	Soil Fertility 1981	Norwest Soil Research Inc., Langley
Dr. M. Coreen Hamilton	Analytical Chemistry 1976	Seakem Oceanography Ltd., Sidney
Dr. Wolfgang Liese	Physics 1977	Seastar Instruments Ltd., Sidney
Dr. Daniel Liu	Organic Chemistry 1983	Quadra Logic Technologies Inc., Vancouver



**AUDITORS' REPORT
TO THE MINISTER OF INTERNATIONAL TRADE,
SCIENCE AND INVESTMENT**

We have examined the balance sheet of the Science Council of British Columbia and Secretariat on Science, Research and Development as at March 31, 1986 and the statements of research appropriations, expenditures and unexpended appropriations and operations appropriation, expenditures and unexpended appropriations for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as we considered necessary in the circumstances.

In our opinion, these financial statements present fairly the financial position of the Council and Secretariat as at March 31, 1986 and the results of their operations for the year then ended in accordance with generally accepted accounting principles, as modified by note 1 to the financial statements, applied on a basis consistent with that of the preceding year.

Coopers & Lybrand

Vancouver, B.C.
May 16, 1986

THE SCIENCE COUNCIL OF BRITISH COLUMBIA
AND SECRETARIAT ON SCIENCE, RESEARCH AND DEVELOPMENT
BALANCE AS AT MARCH 31, 1986

ASSETS

	1986	1985
	\$	\$
Cash and Short-Term Deposits	2,687,194	3,103,822
Accounts Receivable	43,589	43,315
Prepaid Expenses	<u>1,611</u>	<u>1,611</u>
	<u>2,732,394</u>	<u>3,148,748</u>

LIABILITIES

Accounts Payable and Accrued Liabilities	<u>44,963</u>	<u>44,151</u>
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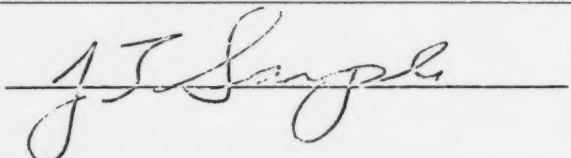
UNEXPENDED APPROPRIATIONS

Research (Note 2)	2,574,820	3,055,659
Operations (note 3)	<u>112,611</u>	<u>48,938</u>
	<u>2,687,431</u>	<u>3,104,597</u>
	<u>2,732,394</u>	<u>3,148,748</u>

COMMITMENTS (Schedule and notes 2 and 3)

Approved by the Council and Secretariat





THE SCIENCE COUNCIL OF BRITISH COLUMBIA
AND SECRETARIAT ON SCIENCE, RESEARCH AND DEVELOPMENT
STATEMENT OF RESEARCH APPROPRIATIONS, EXPENDITURES
AND UNEXPENDED APPROPRIATIONS
FOR THE YEAR ENDED MARCH 31, 1986

	1986	1985
RESEARCH APPROPRIATIONS	\$	\$
Grants from the Province of British Columbia	3,500,003	3,200,000
Interest	300,554	382,103
Refunds of prior years' research expenditures	118,720	84,976
Other	<u>7,295</u>	<u>10,344</u>
	3,926,572	3,677,423
RESEARCH EXPENDITURES-see Schedule		
Research Grants	3,389,748	3,379,089
Industrial Post-Doctoral Fellowships (IPDF)	187,500	162,500
Graduate Research Engineering and Technology (GREAT) Awards	624,000	654,500
Science and Engineering awards	26,311	12,016
Special requests	76,798	184,184
Special projects	93,529	29,190
Honoraria and other expenses	<u>9,525</u>	<u>9,870</u>
	4,407,411	4,431,349
EXCESS OF EXPENDITURES OVER APPROPRIATIONS FOR THE YEAR		
	(480,839)	(753,926)
UNEXPENDED APPROPRIATIONS-BEGINNING OF YEAR	3,055,659	3,809,585
UNEXPENDED APPROPRIATIONS-END OF YEAR (encumbered by outstanding commitments) (note 2)	<u>2,574,820</u>	<u>3,055,659</u>

THE SCIENCE COUNCIL OF BRITISH COLUMBIA
AND SECRETARIAT ON SCIENCE, RESEARCH AND DEVELOPMENT
STATEMENT OF OPERATIONS APPROPRIATIONS, EXPENDITURES
AND UNEXPENDED APPROPRIATIONS
FOR THE YEAR ENDED MARCH 31, 1986

OPERATIONS APPROPRIATIONS	1986	1985
	\$	\$
Grants from the Province of British Columbia	300,000	249,700
Interest	<u>10,709</u>	<u>8,488</u>
	<u>310,709</u>	<u>258,188</u>

EXPENDITURES

Computer services	6,004	3,750
Consulting fees	2,859	630
Furniture and equipment	5,422	22,986
Information services		3,203
Leasehold improvements		5,873
Meetings	3,365	2,290
Moving		5,473
Personnel recruitment		840
Photocopying and printing	22,813	19,402
Postage and courier	7,679	4,553
Professional fees	4,958	5,898
Publications	1,922	895
Rent	30,180	46,718
Salaries and employee benefits	249,525	278,765
Stationery and supplies	2,762	2,877
Telephone	10,089	10,710
Travel	<u>11,735</u>	<u>9,371</u>
	<u>359,313</u>	<u>424,234</u>

RECOVERY OF EXPENDITURES

British Columbia Health Care Research Foundation	111,916	106,456
British Columbia Innovation Office		12,393
Other	<u>361</u>	<u>1,116</u>
	<u>112,277</u>	<u>119,965</u>

EXCESS (DEFICIENCY) OF APPROPRIATIONS OVER EXPENDITURES FOR THE YEAR	63,673	(46,081)
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UNEXPENDED APPROPRIATIONS-BEGINNING OF YEAR	<u>48,938</u>	<u>95,019</u>
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UNEXPENDED APPROPRIATIONS-END OF YEAR (note 3)	<u>112,611</u>	<u>48,938</u>
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**THE SCIENCE COUNCIL OF BRITISH COLUMBIA
AND SECRETARIAT ON SCIENCE, RESEARCH AND DEVELOPMENT
NOTES TO FINANCIAL STATEMENTS
FOR THE YEAR ENDED MARCH 31, 1986**

1. ACCOUNTING POLICIES

Fixed Assets

Fixed assets are not capitalized and depreciated as assets of the Council and Secretariat, but are written off in the period in which they are purchased.

Research Grants

Outstanding research grant commitments are conditional on receipt of satisfactory progress reports and are not recorded until actually disbursed.

2. RESEARCH GRANT COMMITMENTS (See Schedule)

During the year, the Council approved funding for research projects, IPDF's, GREAT's, Science and Engineering awards, special requests, special projects, honoraria and other expenses totalling \$4,349,874. At March 31, 1986, known outstanding commitments totalled \$2,513,317 which, together with additional estimated renewed commitments for the year ending March 31, 1987 of \$1,949,194, amount to \$4,462,511 in known and estimated outstanding commitments.

3. OPERATIONS APPROPRIATIONS

Included in unexpended appropriations is an amount of \$40,000 reserved for leasehold improvements.

4. COMPARATIVE FIGURES

Certain amounts have been reclassified to conform with the presentation adopted for the year ended March 31, 1986.

**THE SCIENCE COUNCIL OF BRITISH COLUMBIA
AND SECRETARIAT ON SCIENCE, RESEARCH AND DEVELOPMENT
SCHEDULE OF COMMITMENTS AND DISBURSEMENTS OF SCIENCE COUNCIL RESEARCH GRANTS
FOR THE YEAR ENDED MARCH 31, 1986**

	Known outstanding commitments beginning of year \$	Additional commitments during year \$	Commitment reductions during year \$	Disbursed during year \$	Known outstanding commitments end of year \$	Estimated renewed commitments 1986-1987 \$	Known and estimated outstanding commitments at March 31, 1986 \$
RESEARCH GRANTS							
Research Competition #2	3,000			3,000			
Research Competition #3	28,490			28,490			
Research Competition #4	80,512		(4,928)	75,584			
Research Competition #5	80,825		(14,310)	48,033	18,482		18,482
Research Competition #6	97,962		(75,689)	14,303	7,970		7,970
Research Competition #7	284,062		(14,993)	257,446	11,623		11,623
Research Competition #8	187,495		(24,536)	155,933	7,026		7,026
Research Competition #9	332,824		(35,590)	239,792	57,442		57,442
Research Competition #10	548,011	12,000	(93,699)	380,610	85,702		85,702
Research Competition #11	1,124,006		(23,185)	850,734	250,087		250,087
Research Competition #12		1,448,003	(41,400)	709,727	696,876	780,573	1,477,449
Research Competition #13		1,762,620		626,096	1,136,524	658,621	1,795,145
	<u>2,767,187</u>	<u>3,222,623</u>	<u>(328,330)</u>	<u>3,389,748</u>	<u>2,271,732</u>	<u>1,439,194</u>	<u>3,710,926</u>
IPDF's	93,750	250,000	(18,750)	187,500	137,500	150,000	287,500
GREAT's		624,000		624,000		360,000	360,000
SCIENCE AND ENGINEERING AWARDS		<u>26,311</u>		<u>26,311</u>			
SPECIAL REQUESTS							
Arts, Science and Technology Centre:							
Director		60,000			60,000		60,000
Regional Science Fair		14,000		12,600	1,400		1,400
Youth Fairs	1,194		(1,194)				
BC Research-Artificial Light		36,515		27,470	9,045		9,045
BC.S.T.A. Book Prize 1986	10,000		(4,974)	5,026			
BC.T.S.A./F.I.S.A.							
Book Prize 1986		14,500		1,000	13,500		13,500
BC.S.T.A.							
Space Update 1986		1,000		1,000			
Canadian Centre of Creative Technology-Student		3,000	(2,858)	142			
MacDonald							
Dettwiler-ROMAC	13,000			13,000			
H.R. MacMillan Planetarium	1,300				1,300		1,300
H.R. MacMillan Planetarium Halley's Comet		18,400		16,560	1,840		1,840
	<u>25,494</u>	<u>147,415</u>	<u>(9,026)</u>	<u>76,798</u>	<u>87,085</u>		<u>87,085</u>
SPECIAL PROJECTS							
Project Review Program	31,000			31,000			
Public Information	12,000	45,000	(2,471)	54,529			
Public Information Video Project		25,000		8,000	17,000		17,000
	<u>43,000</u>	<u>70,000</u>	<u>(2,471)</u>	<u>93,529</u>	<u>17,000</u>		<u>17,000</u>
HONORARIA AND OTHER EXPENSES		<u>9,525</u>		<u>9,525</u>			
	<u>2,929,431</u>	<u>4,349,874</u>	<u>(358,577)</u>	<u>4,407,411</u>	<u>2,513,317</u>	<u>1,949,194</u>	<u>4,462,511</u>